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(54) A two-way communication device

(57) A two-way communication device comprises an ear-insert member having a vibration pick up type microphone combined with a speaker. A housing unit contains an automatic Vox controlling circuit to control automatically th power levels of transmitted and received signals. The ear insert memb r and the housing unit are connected electrically through wires or through a wireless.

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FIG. 1

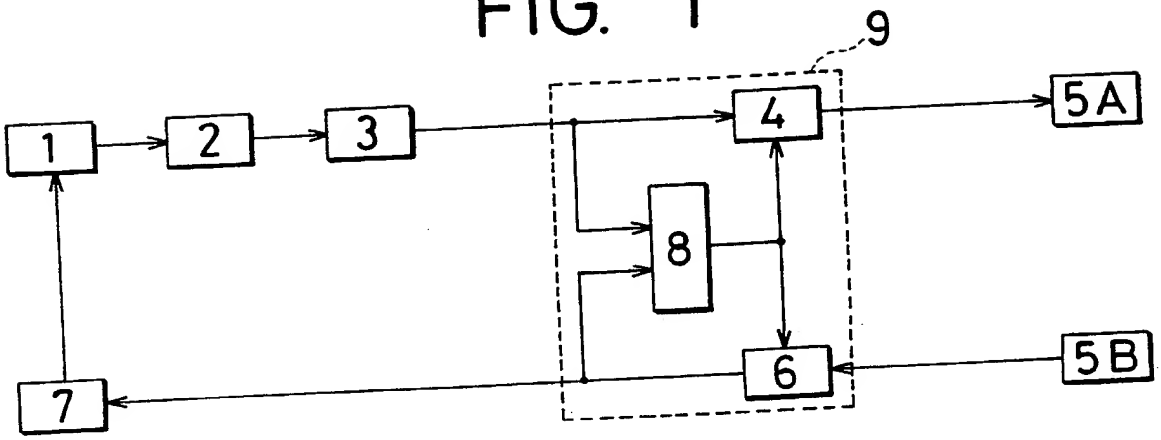


FIG. 2

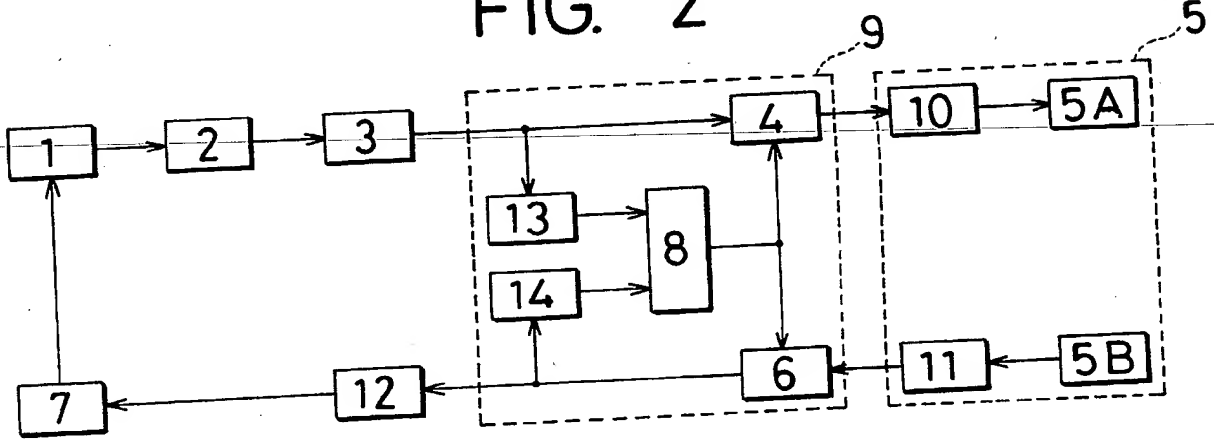


FIG. 3

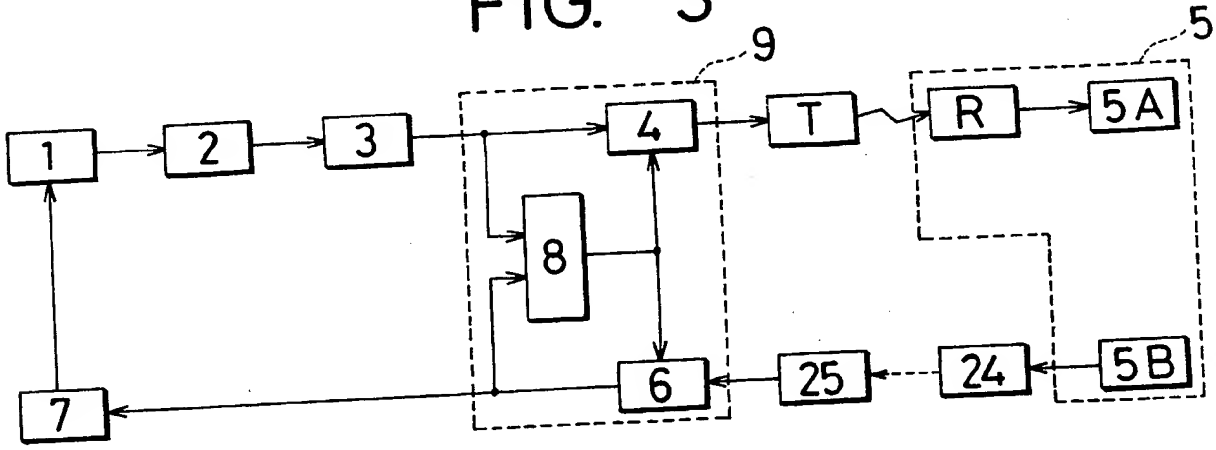


FIG. 4

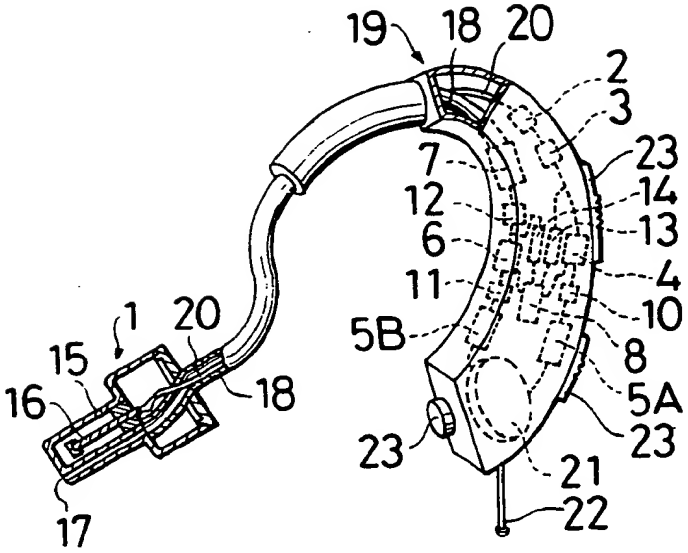


FIG. 5

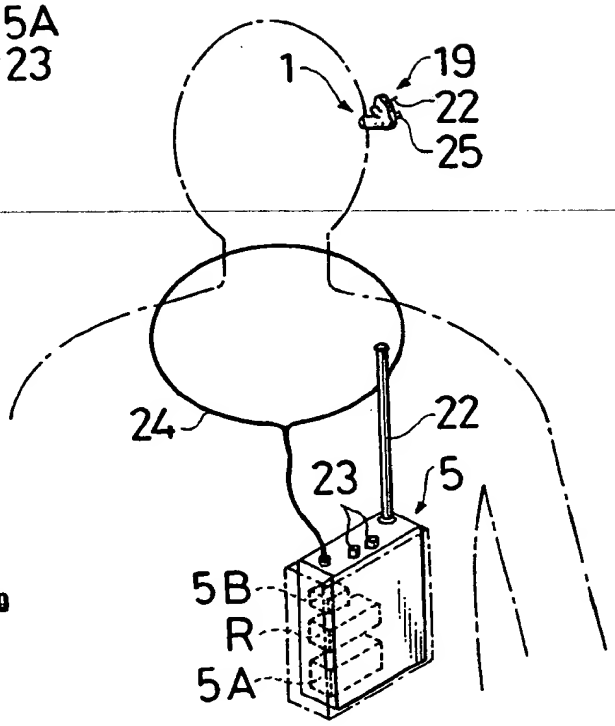
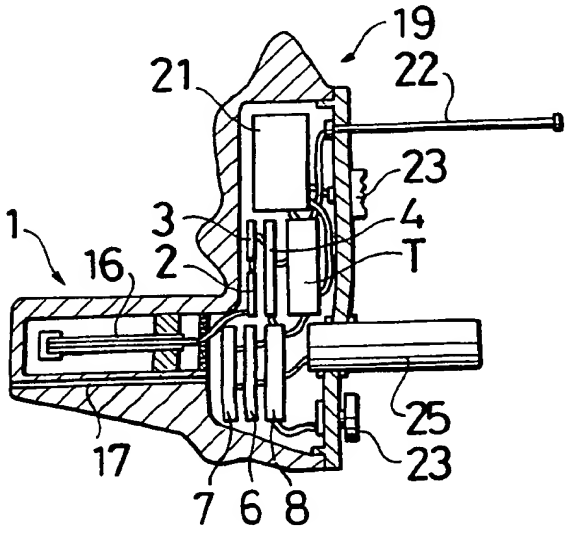


FIG. 6



SPECIFICATION

A two-way communication device

The present invention relates to a two-way communication device. Such a device allows simultaneous talking and listening and uses an ear-insert member, comprising a vibration pick-up type ear microphone combined with a sepaker which may be one of several types, inserted into one ear canal of the user to prevent the occurrence of feedback or "howl-round" when the sound level produced by the speaker is high to allow a user to listen clearly in a very noisy environment.

In a known arrangement, a vibration pick-up type ear microphone (which will hereinafter be referred to as an ear mic) is inserted into the external auditory canal of one ear of a user, and serves to pick up voice signals (vibrations) conducted through his temporal bones around the external auditory canal wall. Such a known ear mic can be combined with a speaker, for instance a conventional sound pressure type earphone or the like.

An arrangement has been tried comprises an ear-insert member comprising the ear mic and a sound pressure type speaker combined with a conventional FM transceiver in order to attempt to transmit and receive in a high noise level environment. However, the following disadvantages were found.

It had been thought that feedback phenomena or "howl-round" would not occur even if the speaker produced a relatively high sound level, because only vibrations conducted through the temporal bones should have been picked up by the ear mic. However, when the speaker sound level was increased, for example, to between 80 and 100 dB, to permit easy listening in a very noisy environment, it was found that the speaker sounds were being picked up by the ear mic, so that "howl-round" occurred.

Moreover, it was found that, if output level of the speaker was set to a relatively high level in order to allow communication in a very noisy environment, the contemplative faculty of the user was adversely influenced.

According to the invention, there is provided a two-way communication device comprising an ear-insert member and a housing unit having electrical circuits, the ear-insert member housing a vibration pick up type microphone combined with a speaker, and an automatic Vox controlling circuit to control automatically the power level of transmitted and received signals being provided in one of electrical circuits of the device.

It is thus possible to provide a two-way communication device which satisfies the following technical requirements (1) to (6):

(1) By using the ear mic in the transmitting system of the device, noises can be excluded so that clear voice sounds can be transmitted when used in a very noisy environment, for example at a sound level of 110 dB(A).

(2) By combining the ear mic with the speaker used in the receiving system of the device, communication, i.e. simultaneous talking and listening, can be achieved through at least one ear of the user leaving his hands free.

(3) The occurrence of howl round is substantially prevented, even when output level of the speaker is relatively high, for example 100 dB, thus permitting clear communication in a very noisy environment.

(4) While the user is talking, the output level of the speaker is reduced, whereas, during listening, the signal level from the ear mic is decreased and the output level of the speaker increased.

(5) When communication is performed by a wireless transmitting and receiving system, a conventional device such as a two-band transceiver can be used. If a wire system is used, a conventional wire transmitting and receiving device such as an interphone can be used.

(6) While the user is talking and listening, it is not necessary for both ears to be closed completely, so that he can listen to sounds around him to improve safety; in this case, an ear-insert member comprising the ear mic and speaker is inserted into one ear canal, which, however, is not closed up completely.

A preferred two-way communication device uses only one ear of a user into which an ear-insert member is placed comprising the ear mic and speaker and having an automatic Vox controlling circuit. The automatic Vox controlling circuit provides automatic gain controlling to make the output level of received signals in low and the input level of transmitted signals high when the user is talking, and in contrast with this, when the user is listening, to make the transmitted level low and the received level high.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 to *3* are block diagrams of preferred embodiments of the present invention;

Figure 4 is an isometric view, partly cut away, of an ear hanging type embodiment of the present invention.

Figure 5 is an isometric view showing another embodiment of the present invention.

Figure 6 is a sectional view of an ear-insert member shown in Figure 5.

Figure 1 is a diagram of a first embodiment comprising a wireless system for two-way communication. The output signals of an ear mic 1, which picks up vibrations conducted through the temporal bones in the external auditory canal and converts them to electrical signals, are transmitted by a transmitting circuit 5A of a radio set 5 through amplifier 2, a band-pass filter 3, and a variable attenuator 4.

Signals received by a receiving circuit 5B of the radio set 5 are transduced to audible sounds pressure type speaker 7, which is combined with the ear mic 1, through a variable attenuator 6.

In the above transmitting and receiving system, the output and input signals are detected by a detector, and the detected signals are supplied to a comparator circuit 8 to control or correct the variable attenuator 4 and 6. Thus, an automatic Vox controlling circuit 9 is provided by the variable attenuator 4, 6 and the comparator circuit 8.

Another preferred embodiment of the present invention is illustrated in Figures 2 and 4. In a transmitting system of this embodiment, output signals of an ear mic 1 are amplified by a pre-amplifier 2 and supplied to a band-pass filter 3 having a frequency pass-band of 500 to 3,000 Hz. The signals are then supplied to an FM amplifier 10 of the wireless radio set 5 through the variable attenuator 4, and are broadcast by the transmitting circuit 5A in the form of an FM transmitter.

In a receiving system of this embodiment, input signals are received by the receiving circuit 5B, which for example comprises RX. ANT Filter and RF & LF amplifier are supplied to an AF amplifier 12 through the variable attenuator 6, to be transduced to audible sounds. In the above systems, the transmitting and receiving signals are each detected by detectors 13 and 14, and supplied to a comparator circuit 8, by which the variable attenuator 4 and 6 are controlled so as to reduce the level of the received signals when level of the transmitted signals is high, i.e. when the user is talking, and so as to reduce the level of the transmitted signals and simultaneously increase the level of the received signals when the user has finished talking.

The transmitting and receiving device is formed as a "one-ear-hanging" type, ear-insert type, or helmet type, or is housed in a spectable frame.

An embodiment of an ear hanging-type of device is shown in Figure 4. Numeral 1 represents the ear mic inserted into the external auditory canal of one ear of the user, the ear mic 1 comprising a case 15 having a sound path 17 and a vibration pick up member 16 such as a piezoelectric element. The ear mic 1 is connected to an ear hanging member 19 through a tube 18 in which leads 20 are housed to transmit output signals of the vibration pick up member 16 to electrical circuits housed in the ear hanging member 19.

In Figure 4, numeral 21 represents an electrical power source, 22 an antenna, 23 a switch, and the other numerals in this Figure represent the same parts as in Figure 2.

Although the above description relates to an embodiment using a wireless system, the invention can be used with a wire transmitting and receiving system.

The ear-insert member can be connect through a wireless system without using the tube and leads shown in Figure 4 to a portable housing unit, and such an embodiment is shown in Figures 3, 5 and 6.

In the transmitting system of this embodiment, the output signals of the ear mic 1 housed in the ear-insert member 19 are transmitted by a wireless transmitter T such as an FM transmitter housed in the ear-insert member 19, and the transmitted signals are received by a receiver R housed in a portable housing unit 5, from which the user's speech is transmitted to another user. In the receiving system, speech signals from the other user are received by a receiving circuit 5B included in the portable housing unit 5, and the received signals are transmitted to the ear-insert member 19 through an inductive system comprising a loop antenna 24 fixed to the portable housing unit 5 and an induction coil 25 fixed to the ear-insert member 19. The received signals are then transduced to audible signals by the sound pressure type speaker 7 and are passed into the external auditory canal of the user through the sound path 17. Although in this embodiment the Vox controlling circuit 9 is shown in the ear-insert member 19, it may alternatively be disposed in the portable housing unit 5.

This embodiment allows transmitting and receiving operations at high power levels to be used for remote communication, and permits greater freedom of movement to the user. Because there are no leads or the like to connect the ear-insert member to the portable housing unit, it is less likely that the ear mic would pick up electrical noise to which leads might be susceptible.

CLAIMS

1. A two-way communication device comprising an ear-insert member and a housing unit having electrical circuits, the ear-insert member housing a vibration pick up type microphone combined with a speaker, and an automatic Vox controlling circuit to control automatically the power level of transmitted and received signals being provided in one of electrical circuits of the device.

2. A two-way communication device as claimed in claim 1, wherein the ear-insert member and the housing unit are connected through a wire system which comprises a tube containing leads and defining a sound path through which audible sounds pass from the speaker into the external auditory canal of a user.

3. A two-way communication device as claimed in claim 1, wherein the ear-insert member and the housing unit are connected through a wireless system.

4. A two-way communication device substantially as hereinbefore described with eference to and as illustrated in the accompanying drawings.

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